

FACTSHEET

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Anthrax

Anthrax, a disease of mammals and humans, is caused by a spore-forming bacterium called *Bacillus anthracis*. Anthrax has an almost worldwide distribution and is a zoonotic disease, meaning it may spread from animals to humans. All mammals appear to be susceptible to anthrax to some degree, but ruminants—such as cattle, sheep, and goats—are the most susceptible and commonly affected, followed by horses, and then swine. In ruminants, the disease is generally characterized by sudden death. Ruminants contract the disease primarily through ingestion of soilborne anthrax spores. Anthrax does not spread by contact between animals.

Anthrax has received greater attention recently because of its potential as an agent in biological weapons, both on the battlefield and in a terrorist strike.

Where Anthrax Occurs

Globally, very few countries claim to be completely unaffected. Anthrax remains common in southern and eastern Europe, the Middle East, South and Central America, several republics of the former Soviet Union, several countries of Africa and Asia, and provinces of China. Sporadic outbreaks are reported from many other countries, including the United States. Although most U.S. States have reported outbreaks, the most recent reports of outbreaks in animals have been from some Central and Southern States.

Epidemiology

During their vegetative stage, cells of the anthrax agent multiply in the lymph nodes of susceptible animals, including humans. When cells of *B. anthracis* escape from the animal's body and are exposed to oxygen, they form spores. These spores are highly resistant to heat, cold, chemical disinfectants, and long dry periods. *B. anthracis* spores are reported to survive for years in the environment. Environmental persistence may be

related to a number of factors, including high levels of soil nitrogen and organic content, alkaline soil (a pH level higher than 6.0), and ambient temperatures higher than 60 °F. The anthrax organism may be spread within an area by streams, insects, wild animals and birds, and contamination from wastes of infected animals. Anthrax may be perpetuated in nature by hosts such as a wildlife reservoir, which in turn spills over into the livestock population.

Animals are usually infected by ingesting soilborne spores, such as in contaminated food or water. Spores can be picked up directly from the soil through grazing or from feed grown on infected soil. When periods of drought cause livestock to forage much closer to the ground, animals may ingest spores in soil they accidentally eat along with forage. After flooding, the concentration of spores caught in standing water increases when preexisting or transitory ponds begin to evaporate. Spores may also be present in bonemeal, protein concentrates, excreta, and tissue and body fluids of infected carcasses.

Although rare, it is possible for animals to inhale dust harboring anthrax spores. Bites from flies and other insects that may harbor vegetative anthrax have also been reported to be vehicles for mechanical transmission.

Clinical Signs

Disease occurs when spores enter the body, germinate, multiply, and release toxins. The incubation period of natural infection in animals is typically 3 to 7 days with a range of 1 to 14 days, or more. Anthrax occurs in at least three forms that are determined by the length of clinical course of disease: (1) a peracute form (1–2 hours' duration), (2) acute form (24–48 hours' duration), or (3) subacute to chronic form. Ruminants are the most likely to manifest the peracute and acute forms; horses, the acute form; and dogs, cats, and pigs, subacute to chronic forms or localized conditions. Sudden death in animals that appeared normal a few hours earlier is common.

In Ruminants—In cattle and sheep, the course of illness may last about 1 to 2 hours. Clinical signs, such as fever up to 107 °F, muscle tremors, respiratory distress, and convulsions, often go unnoticed. After death, there may be bloody discharges from the natural openings of the body, rapid bloating, a lack of rigor mortis, and the presence of unclotted blood. This failure of blood to clot is due to a toxin released by *B. anthracis*.

The acute form of anthrax may be observed over a course of about 24 to 48 hours. Affected animals may have a high fever, complete anorexia, diarrhea, severe depression, and listlessness. There may be local edema of the tongue with accumulation of edema fluid in the throat, sternum, perineum, or flanks. Pregnant cows may abort. Milk production may drop severely; the milk may be blood stained or yellow.

In Horses and Their Relatives—Anthrax in horses and related animals is acute and can last up to 96 hours. Clinical manifestations depend upon how the infection occurred. If due to ingestion of spores, as in cattle, septicemia, fever, colic, and enteritis are prominent. Anthrax due to insect bite introduction (mechanical transmission) is characterized by localized hot, painful, edematous, and subcutaneous swellings at the bite location that spread to the throat, lower neck, floor of the thorax, abdomen, prepuce, and mammary glands. These horses may have a high fever and dyspnea due to swelling of the throat, or colic due to intestinal involvement.

In Swine, Dogs, and Cats—Swine, dogs, and cats usually show a subacute to chronic localized form of disease. There is a characteristic swelling of the neck secondary to regional lymph node involvement which causes dysphagia and dyspnea following ingestion of the bacteria. An intestinal form of anthrax with severe enteritis sometimes occurs in these species. Many carnivores apparently have a natural resistance, and recovery is not uncommon.

Diagnosis

Sudden death in an animal without prior symptoms should lead to a suspicion of anthrax. If anthrax is suspected as the cause of death, the affected carcass should not be opened because exposure of the vegetative anthrax bacteria to air induces spore formation, contaminating the environment and presenting a health risk to personnel and other nearby animals.

Diagnosis can be confirmed by aseptically collecting a postmortem blood sample from a peripheral vein (e.g., the jugular vein) and examining a blood smear for the presence of the bacillus

capsule using a suitable stain (e.g., M'Fadyean methylene blue stain) or by culturing the bacilli.

In the event an infected carcass is inadvertently opened, postmortem examination of ruminants may show (1) a rapidly decomposing carcass; (2) bloody discharges from the nose, mouth, or anus; (3) a lack of rigor mortis; (4) the presence of dark, tarlike unclotted blood; (5) lesions consistent with generalized septicemia; and (6) an enlarged spleen having a "blackberry jam" consistency. In horses, lesions are generally confined to the edematous infiltration of the tissues in the neck area. In swine, there is often extensive edema around the lymph nodes.

Veterinarians and other personnel should take precautions to avoid skin contact with potentially contaminated carcasses and soil. Personal protective equipment (PPE), such as impermeable gloves, boots, and clothing, should be used. Disposable PPE should be used, but if not available, decontamination of PPE should be completed. Although the risk of respiratory infection is extremely small, veterinarians and other personnel conducting postmortems, soil remediations, and disposal of animal carcasses should wear respirators with a high-efficiency particulate air (HEPA) filter.

Human Health Risk

In humans, anthrax infection can occur in three forms: cutaneous (skin), inhalational, and gastrointestinal. Direct person-to-person spread of anthrax most likely does not occur.

Cutaneous anthrax, which results from exposure to spores or vegetative cells to broken skin (e.g., cut, abrasion, insect bite), accounts for 95–98 percent of anthrax cases. This type of anthrax results in fluid-filled vesicles that, after rupturing, progress to ulcers with characteristic black scabs in the center.

Inhalational anthrax may occur when a person inhales high numbers of aerosolized spores, such as during the processing of wool, hair, or hides from infected animals. This type of anthrax was called "woolsorters' disease" because factory workers often contracted it after sorting and grading contaminated wool products. The disease is also a danger to workers in other fields who may come into contact with anthrax-infected carcasses.

Intestinal anthrax develops after ingestion of contaminated food or drink. No such cases have been reported in the United States. Anthrax should not pose a health hazard to consumers of meat because animals are inspected for disease by Federal and State meat inspectors before, during, and after slaughter.

Prevention, Treatment, and Control Measures

The U.S. Department of Agriculture's Animal and Plant Health Inspection Service (APHIS) restricts the importation of animals and animal products from countries where anthrax infections occur. In order to protect domestic livestock against anthrax infection, many animals and animal products must be certified by foreign animal health officials, quarantined, or cleaned and disinfected at import centers prior to entry into the United States.

Annual vaccination of livestock in endemic anthrax areas is recommended. The most widely used vaccine for the prevention of anthrax in animals is the Sterne-strain vaccine. This vaccine, a nonencapsulated live variant strain of *B. anthracis*, was developed by Sterne in 1937. Immunity develops about 7–10 days after vaccination. (Note: Anthrax vaccines licensed for use in animals should not be used in humans. The anthrax vaccine licensed for human use in the United States is a cell-free filtrate vaccine.)

B. anthracis is highly susceptible to a number of antimicrobial agents. Penicillin and oxytetracycline have been reported as the most therapeutically effective agents. Because the live spore vaccine must germinate and grow in the vaccinated animal's body to provide protection, antibiotics should not be administered to healthy animals either at the time of, or shortly after, the administration of the anthrax vaccine.

All outbreaks of anthrax should be reported to State or Federal animal and public health officials. In general, quarantines should be placed on affected premises, and all susceptible healthy livestock on affected and surrounding premises should be vaccinated. Carcasses of animals that die of anthrax should be burned and/or buried deeply to reduce environmental contamination. Because burial alone may provide a potential future exposure source resulting in new animal cases, burning carcasses should be the primary disposal method. In addition, bedding and other material found around the carcass (e.g., soil) should also be burned and/or buried. Covering the carcass and affected area with quicklime (anhydrous calcium oxide) is also recommended.

Additional Information

For more information, contact

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For public health information, contact the Centers for Disease Control and Prevention in Atlanta, GA, at (404) 639–3158.

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